

### **Amendments to the Claims**

The following Listing of Claims contains the claims that currently are pending in the application.

#### **Listing of Claims:**

Claims 1-46 (canceled)

Claim 47 (previously presented): A vertical cavity surface emitting laser (VCSEL), comprising:

- a first mirror stack;

- a second mirror stack;

- a cavity region disposed between the first mirror stack and the second mirror stack, wherein the first mirror stack, the cavity region, and the second mirror stack are arranged along a vertical direction, and the cavity region includes an active region, a first side facing the first mirror stack, and a second side facing the second mirror stack;

- a defect source located such that only one of the first and second sides of the cavity region faces the defect source; and

- a reliability-enhancing layer positioned within the defect source and producing a localized strain field within the defect source to reduce migration of defects in the vertical direction from the defect source to the active region, whereby the reliability-enhancing layer reduces defect-induced degradation of the active region by the defect source.

Claim 48 (previously presented): A vertical cavity surface emitting laser (VCSEL), comprising:

- a first mirror stack;

- a second mirror stack;

- a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;

- a defect source;

- a first reliability-enhancing layer positioned with respect to the defect source and producing a localized strain field to reduce defect-induced degradation of the active region by

the defect source, wherein the defect source is disposed between the reliability-enhancing layer and the cavity region; and

a second reliability-enhancing layer positioned with respect to the defect source and producing a localized strain field that reduces defect-induced degradation of the active region by the defect source, wherein the second reliability-enhancing layer is separated from the first reliability-enhancing layer by one or more other layers and the first and second reliability-enhancing layers are located on opposite sides of the defect source.

Claim 49 (canceled)

Claim 50 (currently amended): A vertical cavity surface emitting laser (VCSEL), comprising:

a first mirror stack;

a second mirror stack;

a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;

a strained defect source that creates a first strain field; and

a strained reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-enhancing layer is ~~configured to~~ creates a second strain field that at least in part balances the first strain field created by the defect source.

Claim 51 (currently amended): A vertical cavity surface emitting laser (VCSEL), comprising:

a first mirror stack;

a second mirror stack;

a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;

a defect source ~~The VCSEL of claim 50,~~ wherein the defect source includes an oxide region inducing a compressive strain field; and

a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-enhancing

layer is configured to at least in part balance strain created by the defect source, and the reliability-enhancing layer is positioned within the compressive strain field and is characterized by tensile strain.

Claim 52 (currently amended): A vertical cavity surface emitting laser (VCSEL), comprising:

a first mirror stack;

a second mirror stack;

a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;

a defect source; and

a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-enhancing layer is configured to at least in part balance strain created by the defect source;

~~The VCSEL of claim 50,~~ wherein at least one of the first and second mirror stacks comprises oxidized AlGaAs layers, the defect source corresponds to at least one of the oxidized AlGaAs layers, and the reliability-enhancing layer is formed from  $\text{In}_x\text{Ga}_{1-x}\text{P}$ , wherein  $x < 0.5$  tensile.

Claim 53 (previously presented): A vertical cavity surface emitting laser (VCSEL), comprising:

a first mirror stack;

a second mirror stack;

a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;

a defect source; and

a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the defect source creates a concentration gradient inducing defect migration, and the reliability-enhancing layer introduces strain that reduces the induced defect migration.

Claim 54 (previously presented): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

- forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the first mirror stack, the cavity region, and the second mirror stack are arranged along a vertical direction, and the cavity region includes an active region, a first side facing the first mirror stack, and a second side facing the second mirror stack;

- forming a defect source located such that only one of the first and second sides of the cavity region faces the defect source; and

- forming a reliability-enhancing layer, wherein the reliability-enhancing layer is positioned within the defect source and produces a localized strain field within the defect source that reduces migration of defects in the vertical direction from the defect source to the active region, whereby the reliability-enhancing layer reduces defect-induced degradation of the active region by the defect source.

Claim 55 (previously presented): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

- forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

- forming a defect source;

- forming a first reliability-enhancing layer producing a localized strain field positioned with respect to the defect source to reduce defect-induced degradation of the active region by the defect source, wherein the defect source is disposed between the reliability-enhancing layer and the cavity region; and

- forming a second reliability-enhancing layer producing a localized strain field positioned with respect to the defect source to reduce defect-induced degradation of the active region by the defect source, wherein the second reliability-enhancing layer is separated from the first reliability-enhancing layer by one or more other layers and the first and second reliability-enhancing layers are located on opposite sides of the defect source.

Claim 56 (canceled)

Claim 57 (currently amended): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

forming a strained defect source that creates a first strain field; and

forming a strained reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-enhancing layer creates a second strain field that is configured to at least in part balance the first strain field created by the defect source.

Claim 58 (currently amended): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

forming a defect source~~The method of claim 57,~~ wherein the defect source includes an oxide region inducing a compressive strain field; and

forming a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-enhancing layer is configured to at least in part balance strain created by the defect source, and the reliability-enhancing layer is positioned within the compressive strain field and is characterized by tensile strain.

Claim 59 (currently amended): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region~~The method of claim 57,~~ wherein at least one of the first and second mirror stacks comprises oxidized AlGaAs layers;

forming a defect source, wherein the defect source corresponds to at least one of the oxidized AlGaAs layers; and

forming a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-

enhancing layer is configured to at least in part balance strain created by the defect source,  
and the reliability-enhancing layer is formed from  $\text{In}_x\text{Ga}_{1-x}\text{P}$ , wherein  $x < 0.5$  tensile.

Claim 60 (previously presented): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

forming a defect source; and

forming a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the defect source creates a concentration gradient inducing defect migration, and the reliability-enhancing layer introduces strain that reduces the induced defect migration.

Claim 61 (previously presented): The VCSEL of claim 50, wherein the reliability-enhancing layer is adjacent the defect source.

Claim 62 (currently amended): A vertical cavity surface emitting laser (VCSEL), comprising:

a first mirror stack;

a second mirror stack;

a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;

a defect source; and

a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions~~The VCSEL of claim 50, wherein the reliability-enhancing layer is within the defect source~~ and is configured to at least in part balance strain created by the defect source.

Claim 63 (previously presented): The method of claim 57, wherein the reliability-enhancing layer is adjacent the defect source.

Claim 64 (currently amended): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

forming a defect source; and

forming a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions~~The method of claim 57,~~  
wherein the reliability-enhancing layer is within the defect source and is configured to at least in part balance strain created by the defect source.

Claim 65 (previously presented): The VCSEL of claim 53, wherein the defect source creates a Group V element vacancy gradient, and the reliability-enhancing layer has a Group V element vacancy concentration selected to block defect migration from the defect source to the active region.

Claim 66 (previously presented): The method of claim 60, wherein the defect source creates a Group V element vacancy gradient, and the reliability-enhancing layer has a Group V element vacancy concentration selected to block defect migration from the defect source to the active region.

Claim 67 (previously presented): The VCSEL of claim 47, wherein the defect source comprises an implant region.

Claim 68 (previously presented): The method of claim 54, wherein the defect source comprises an implant region.